

**DIRECTIONS** To receive full credit, you must provide complete legible solutions to the following problems in the space provided. No Attached papers. Transfer all your answers to the space provided.

1. Find the velocity, acceleration, and speed of a particle with the given position function.

$$\mathbf{r}(t) = e^t \mathbf{i} + e^{2t} \mathbf{j}$$

Ans \_\_\_\_\_

Ans \_\_\_\_\_

Ans \_\_\_\_\_

2. Find the velocity and position vectors of a particle that has the given acceleration and the given initial velocity and position.

$$\mathbf{a}(t) = 2\mathbf{i} + 6t\mathbf{j} + 12t^2\mathbf{k}, \quad \mathbf{v}(0) = i, \quad \mathbf{r}(0) = 7\mathbf{j} - 2\mathbf{k}$$

Ans \_\_\_\_\_

Ans \_\_\_\_\_

3. Find the tangential and normal components of the acceleration vector.  $\mathbf{r}(t) = (1+t)\mathbf{i} + (t^2 - 2t)\mathbf{j}$

Ans \_\_\_\_\_

Ans \_\_\_\_\_

4. A force with magnitude 15 N acts directly upward from the  $xy$ -plane on an object with mass 3 kg. The object starts at the origin with initial velocity  $\mathbf{v}(0) = \mathbf{i} - \mathbf{j}$ . Find its position function and its speed at time  $t$ .

5. A projectile is fired with an angle of elevation  $\alpha$  and initial velocity  $v_0$ . (See the figure.) Assuming that air resistance is negligible and the only external force is due to gravity, find the position function  $\mathbf{r}(t)$  of the projectile. What value of  $\alpha$  maximizes the range (the horizontal distance traveled)?

Ans \_\_\_\_\_

Ans \_\_\_\_\_

